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*i90*

## Robot User Quick Guide

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**Congratulation** on your investment and welcome to the i90 robot family.

## I. Key Features

**Pan Tilt Zoom (10X) High Resolution CCD Camera** Max 704x480 pixels, max 30fps, 10X optical zoom and 10x digital zoom

**Two-Way Audio**

**Fully Wireless Networked** (WiFi 802.11G)

**Lightweight and Large Payload Capacity** i90 base robot weights 6Kg, Max payload 15Kg (optional 40Kg)

**320x240 Color Programmable Touch LCD**

**Extended Operating Time** 3 hours (i90 base robot with standard battery pack) and upgradeable to 6, 12 or 24 hours in between recharge

**Tele-Operation and Remote Monitoring via Internet** the included *i90 Robot Explorer<sup>TM</sup>* program features remote monitoring, robot control and two-way audio

**Constellation Autonomous Navigation Positioning System** (*optional*) continuously provides up to 1 inch (2 cm) position accuracy and 2 degree orientation accuracy

**Auto-Docking and Auto-Recharge Station** (*optional*) used with Constellation system, providing robot 24x7 fully autonomous operation and self recharging capability without human assistance

**Large Selection of Upgrades** 5 DOF servo arms with gripper, Camera on arm, Stereo Camera Head, 3D laser scanner (range finder), multiple Cameras, long range RFID reader and more

**OS Independent Programming Support** Operating system independent robot control and data communication protocols are provided for developing customized robot program for any operating system or devices that supporting TCP/IP communication. High level ActiveX controls are also provided for fast development under Windows 2000 or XP

## II. i90 Base Robot and Upgrade Options

### i90 Robot Standard Components

<b>i90 mechanical chassis</b>	I90-ME	x1
<b>Pan-tilt-zoom (704X480) CCD camera with two-way audio</b>	AV-PTZ-VH	x1
<b>2W Speaker with amplifier</b>	SP-AM-2W	x1
<b>Color LCD (320x240) PDA</b>	PDM1950	x1
<b>Robot sensing and motion controller</b>	PMS5005	x1
<b>12V DC motor with 800 count optical encoder</b>	MCA-50	x2
<b>DC motor driver module</b>	MDM5253	x1
<b>Ultrasonic range sensor module</b>	DUR5200	x3
<b>Sharp IR distance measuring sensor</b>	GP2Y0A21YK	x7
<b>Pyroelectric human motion sensor module</b>	DHM5150	x2
<b>IO Interface board</b>	EXPIO	x1
<b>WiFi 802.11G wireless module</b>	WFS802G	x1
<b>RS232 cross-over serial cable</b>	CCR2150	x1
<b>RS232 interface module</b>	MCR3210	x1
<b>Power and charge controller</b>	PMCHR12	x1
<b>DC-DC power module</b>	PDCDC-3	x1
<b>Universal power supply</b>	UPS14	x1
<b>12V Ni-MH 3800mAh battery pack</b>	BPN1238	x2
<b>Joystick</b>	LOGIJO	x1
<b>i90 robot explorer program</b>		x1
<b>Software SDK and API</b>		x1

### Upgrade Package I (**Sputnik<sup>2</sup>**)

<b>Sputnik 2</b>		
<b>i90 robot</b>	i90	1
<b>Stereo camera animated head</b>	SCAM-HEAD	1

### Upgrade Package II (**Sentinel<sup>2</sup>**)

<b>Sentinel 2</b>		
<b>i90 robot</b>	i90	1
<b>Constellation navigation/position system</b>	CONST-NAV	1
<b>Constellation navigation/position transponder</b>	CONST-TRAN-STD	3
<b>Auto-docking auto-recharging station</b>	AUTO-CHAR12	1

## Upgrade Package III (**Scout<sup>2</sup>**)

Scout 2		
i90 robot	i90	1
5 DOF servo arm with gripper	SARM-5DOF	2
Mini 640x480 wireless camera	AXCAM	1

## Upgrade Package IV (**Stealth**)

Stealth		
Sentinel 2 robot	Sentinel 2	1
Stereo camera animated head	SCAM-HEAD	1
5 DOF servo arm with gripper	SARM-5DOF	2
Mini 640x480 wireless camera	AXCAM	1

## Individual Upgrade Options

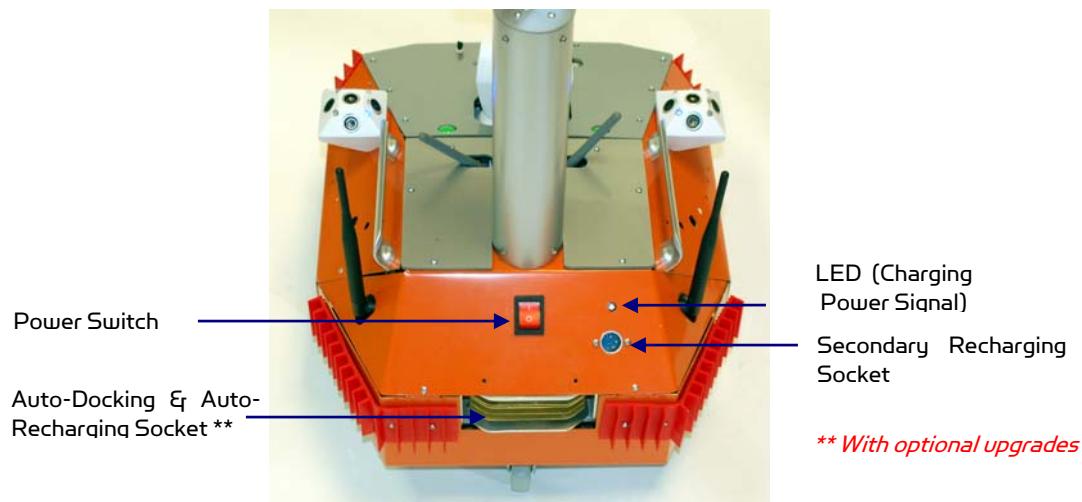
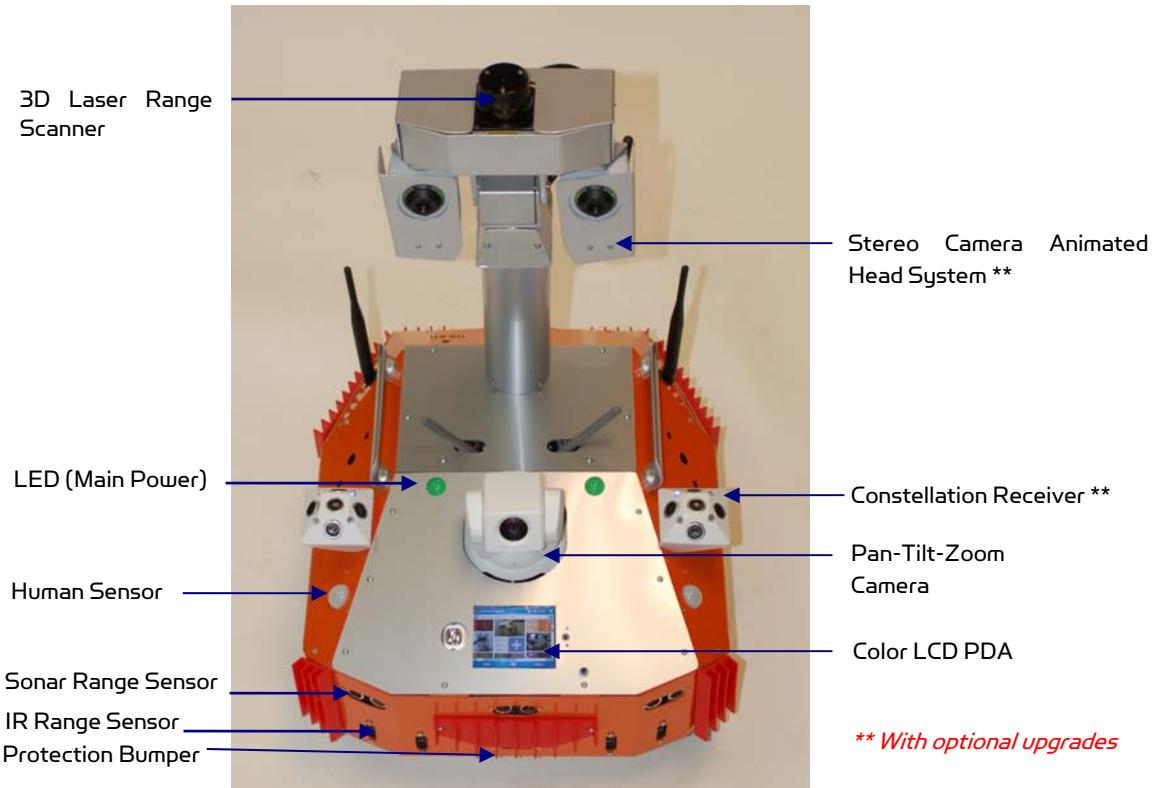
5 DOF servo arm with gripper	SARM-5DOF
Stereo camera animated head	SCAM-HEAD
3D Laser Scanner	3DLAS4M
Mini 640x480 CCD wireless camera	AXCAM
Pan-tilt-zoom (704X480) camera with two-way audio	AV-PTZ-VH
Constellation navigation/position system	CONST-NAV
Long range RFID system (reader and tags)	RFID-LR-U
Constellation navigation/position transponder	CONST-TRAN-SD
Auto-docking auto-recharging station	AUTO-CHAR12
2 X 9000mAH 12V Ni-MH battery	BPN1290

Please contact [info@DrRobot.com](mailto:info@DrRobot.com) for custom design and integration inquiry.

### III. Knowing Your Robot

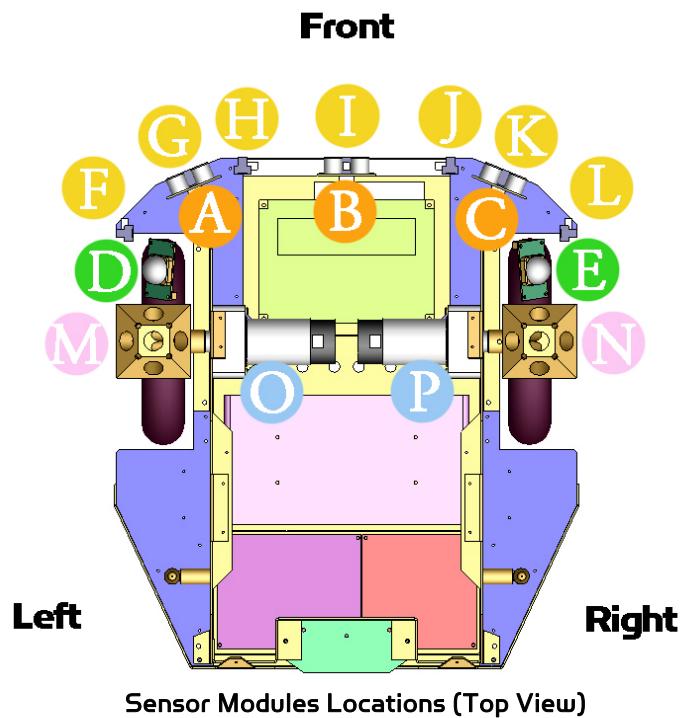
#### External Components

The following figures illustrate the key functional components you should be able to identify on the i90 robot with Sentinel upgrade package, Stereo Camera Animated Head and 3D Laser scanner.



## Numbering of Modules and Servos

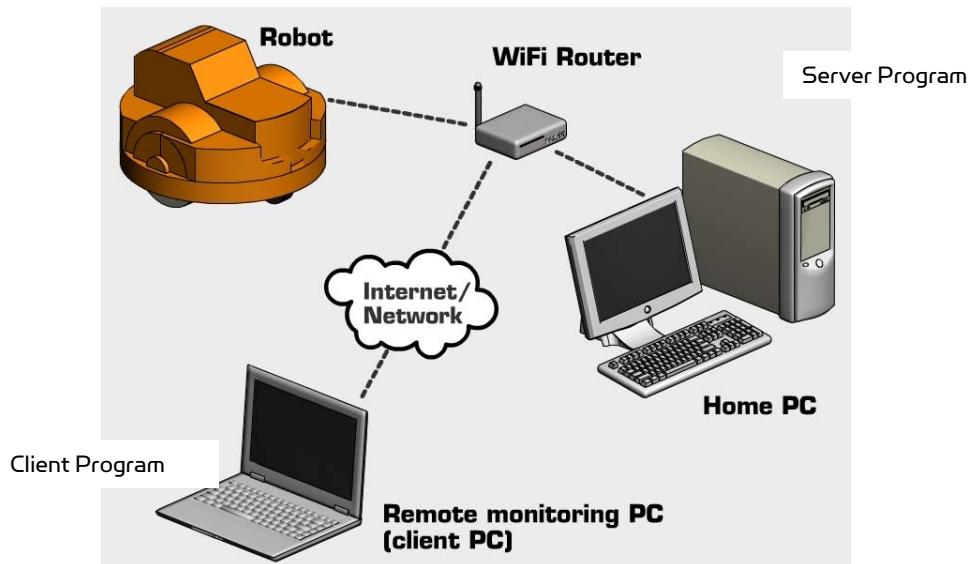
Electrical Module	Location / Setting
Ultrasonic #1	A - Left front
Ultrasonic #2	B - Middle front
Ultrasonic #3	C - Right front
Human Sensor #1	D - Left front, upper lever
Human Sensor #2	E - Right front, upper lever
Infrared Range Sensor #1	F - Front left
Infrared Range Sensor #2	G - Front left
Infrared Range Sensor #3	H - Front middle
Infrared Range Sensor #4	I - Front middle
Infrared Range Sensor #5	J - Front middle
Infrared Range Sensor #6	K - Front right
Infrared Range Sensor #7	L - Front right
Constellation Receiver #1	M - Left Constellation Receiver
Constellation Receiver #1	N - Right Constellation Receiver
DC Motor #1 with quadrature encoder	O - Left , use channel 1
DC Motor #2 with quadrature encoder	P - Right, use channel 2



## Operation Scenario

As shown in the typical operation diagram below, the Home PC running the i90 Robot Explorer program (also called server PC) can be mounted on the robot or off the robot. The Home PC should connect to the wireless router via either:

- Network cable – Connect your PC to one of the LAN ports on the back of the router (DO NOT connect to the WAN port), or
- Wireless – To connect your PC to the wireless router, configure your PC's wireless settings using the default configuration settings shown on the first page of this manual.



## Network Connection

There are over three 802.11G wireless devices in the robot and they are configured with the following wireless network settings:

<b>SSID</b>	dri	<b>Gateway</b>	192.168.0.200
<b>WEP</b>	128bits	<b>Subnet Mask</b>	255.255.255.0
<b>KEY</b>	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	<b>Key Type</b>	Open Key

Wireless Devices	IP
Robot IP (WiFi Module 1)	192.168.0.208
Robot Secondary IP (WiFi Module 2) (option)	192.168.0.205
Main PTZ Camera	192.168.0.199
Color LCD PDA	192.168.0.202
Stereo Camera Animated Head (Left) (Option)	192.168.0.91
Stereo Camera Animated Head (Right) (Option)	192.168.0.90

In this manual, the Server/Home PC network parameters are as following

Home PC / Server	192.168.0.104	192.168.0.200
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The pre-configured wireless 802.11G router has the following settings:

<b>SSID</b>	dri	<b>Router LAN</b>	192.168.0.200
<b>WEP</b>	128bits	<b>Login ID</b>	XXXXXX
<b>KEY</b>	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	<b>Password</b>	XXXXXX
<b>Key Type</b>	Open Key		

With virtual server settings as following

Virtual Server	Port	Protocol	Server IP
i90 Robot Explorer program	7050	TCP/IP	192.168.0.104
i90 Robot Explorer program	7060	TCP/IP	192.168.0.104
i90 Robot Explorer program	7070	TCP/IP	192.168.0.104
Main PTZ Camera	8081	TCP/IP	192.168.0.199
Main PTZ Camera	5002	UDP	192.168.0.199
Main PTZ Camera	5003	UDP	192.168.0.199
Stereo Camera Animated Head (Left)	8082	TCP/IP	192.168.0.91
Stereo Camera Animated Head (Left)	7002	TCP/IP	192.168.0.91
Stereo Camera Animated Head (Left)	554	TCP/IP	192.168.0.91
Stereo Camera Animated Head (Right)	8083	TCP/IP	192.168.0.90
Stereo Camera Animated Head (Right)	7003	TCP/IP	192.168.0.90
Stereo Camera Animated Head (Right)	555	TCP/IP	192.168.0.90

	<b>Login</b>	<b>Password</b>
Wireless Router	XXXXXXX	XXXXXXX
i90 Robot Explorer Program Login	XXXXXXX	XXXXXXX
Main PTZ Camera	XXXXXXX	XXXXXXX
Stereo Camera Animated Head (Left) (Option)	XXXXXXX	XXXXXXX
Stereo Camera Animated Head (Right) (Option)	XXXXXXX	XXXXXXX

## **Internet Remote Monitoring/Tele-operation**

If Internet remote monitoring/control is required, you need to connect the wireless router WAN port to your current broadband Internet modem (this is optional and is not required for running the robot).

If firewall is in-place in your network, you also need to make sure all the networks port used by the wireless devices (e.g. 8081, 5002, 5003 for the main PTZ camera, 8082, 7002, 554 for the 1<sup>st</sup> mini Camera, 8083, 7003 and 555 for the 2<sup>nd</sup> mini Camera) and 7050, 7060, 7070 on the server and remote client sides are not blocked for the Internet remote monitoring/control tasks to operate properly.

## **Advanced Network Settings**

It's possible to use different network settings (e.g. IP) for the server PC, but the "Virtual Server" settings on the router must also be changed accordingly in order for the Internet remote monitoring feature to work properly.

You could also change the router settings such as IP and SSID etc,. If you need to do so, you are required to change the Network settings on the WiFi module on the robot by following the guidelines as illustrated on the WiFi Module manual.

## Recharging

**Note:** The robot must be turned on to be charged.

### To charge the i90 robot with standard charger unit

1. Turn on the robot
2. Plug in and power up the charging unit, and plug the charger cable into the secondary charger socket at the back of the i90 robot.



### To charge the i90 robot with the Auto-Docking Auto-recharging station (optional)

Please see the Auto-docking and Auto Recharging Station session for detail

## IV. Software Installation

Using the i90 Program CD to install:

- i90 Robot Explorer program on the Home/server PC
- i90 Robot Explorer Client program on the remote client PC (if Internet remote operation and monitoring is to be used)
- Dr Robot Map Creator program on the Home/server PC
- Pan-Tilt-Zoom Camera Development Kit (P/N: **AV-PTZ-VH**)
- 5DOF Servo Arm with Gripper control program on the Home/server PC (if the optional 5DOF Servo Arm is installed, P/N: **SARM-5DOF**)
- 3D Laser Scanner Range Finder program on the Home/server PC (if the optional 3D Laser Scanner installed, P/N: **3DLAS4M**)
- Stereo Camera Animated Head Controller program and the Mini Wireless Camera (P/N: **AXCAM**) Development Kit on the Home/server PC (if the optional Stereo Camera Animated Head is installed, P/N: **SCAM-HEAD**)
- RFID Management program on the Home/server PC (if the optional Long Range RFID System is installed, P/N: **RFID-LR-U**)

### Install the Joystick Controller

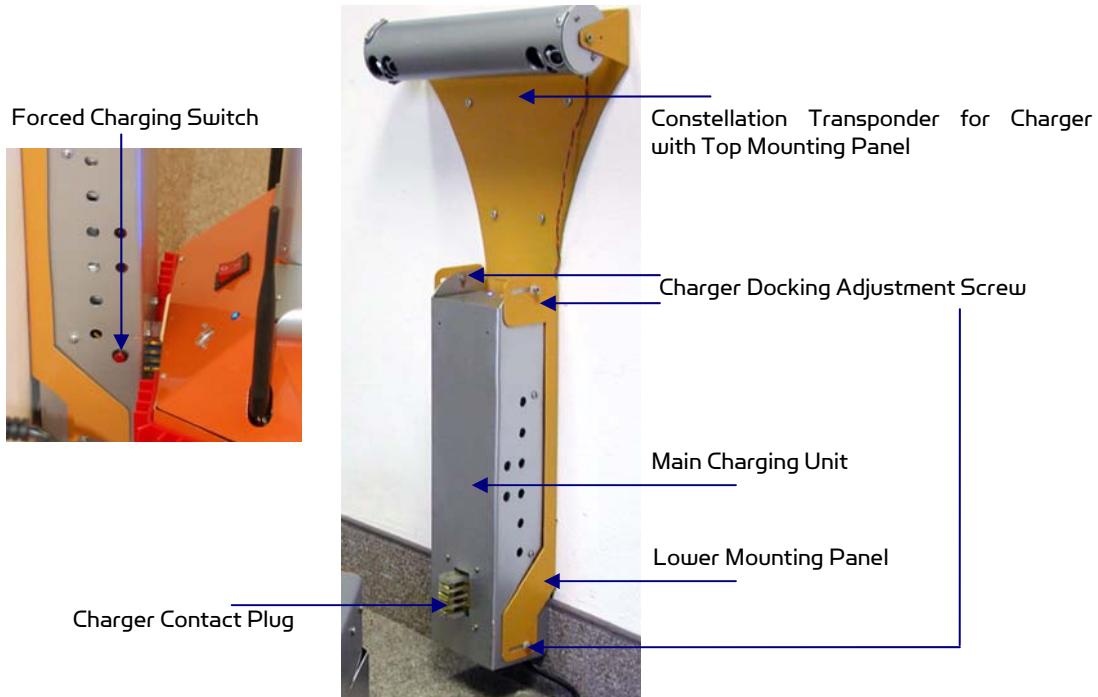
Please follow the installation instructions provided with the joystick controller and install the driver for the device on both the Server and Client PC (if applicable). XP and 2000 normally will recognize the device automatically with plug and play feature.

To verify the joystick installation, run Control Panel > Printers and Other Hardware > Game Controllers. Selecting this option will open a dialog box listing installed hardware typically used for gaming. The installed joystick will appear if it has been properly installed.

## V. Auto-Docking and Auto Recharging Station

### Setting up the Auto-docking and Auto-recharging Station for i90 (with appropriate upgrade)

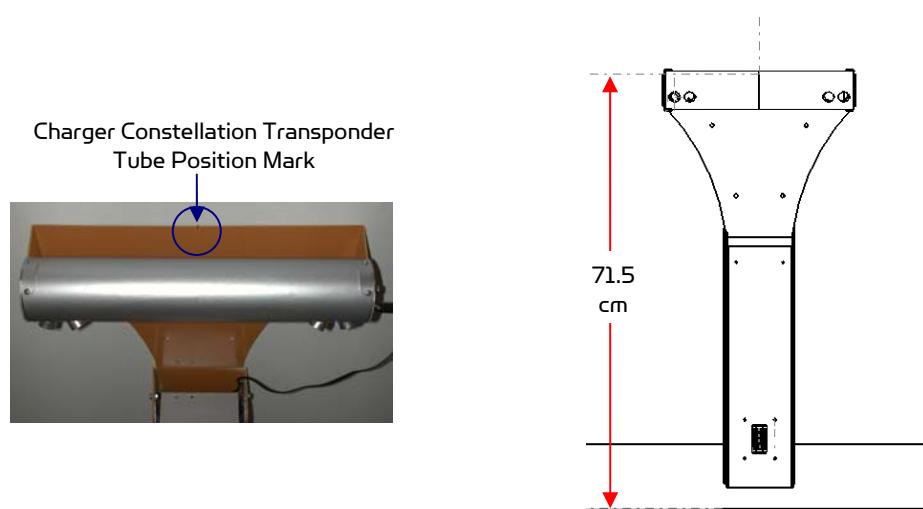
Refer to the figure below; the charging station comes in two parts: Constellation Transponder Tube for charger with top mounting panel, the main charging unit with lower mounting panel.



**Auto-docking and Auto-recharging Station**

Setting up the charging station:

1. Choose an easy access spot on the wall for mounting the charging station. Maker sure the floor is level at the spot for easy setup.
2. Mounting the top panel (pre-assembled with the Constellation Transponder Tube for Charger) with height of 71.5 cm measured from the top edge of the top mounting panel (see figure below) to floor. Use leveler to have it as level as possible.



3. Remove the lower mounting panel from the main charging unit.
4. Mounting the lower panel to the wall under the top mounting panel.
5. Assembling back the main charging unit to the lower panel, don't tighten the "Charger Docking Adjustment Screws"(shown in figure "Auto-docking and Auto-recharging Station" above) yet.
6. Dock the robot (Charging Socket) into the Charger Contact Plug (as shown on the right figure).
7. Tighten adjustment screws; manually push robot out and back it in the charger again. If the docking action is smooth, adjustment is done, otherwise finely adjusting the position of the main charger unit by loosing the adjustment screws and repeat steps above.
8. Plug the small power connector into the Constellation Transponder tube.
9. Plug the main power cord to the wall power unit.



## Autonomous Recharging

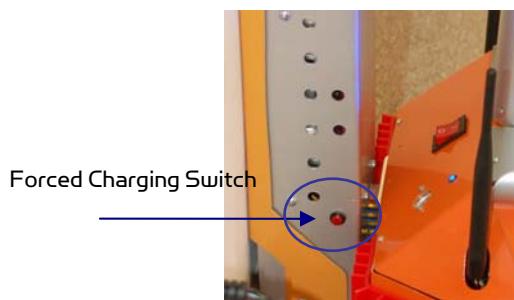
When the robot is running at auto Patrol mode, when the batteries are running low, robot will automatically return to the charger and charge.

## Manual Command of Self-Docking Recharging

Using the "Docking" or "Charge" function button found on the i90 Robot Explorer Server or Client software to dock the robot into the charging station and recharge.

## Manual Forced Recharging

When manual recharge is required, first manually dock the robot into the charging station, with robot run on, toggle on the "Forced Charging Switch" found on the lower right side of the charging unit as shown below. The charging LED light on the back of the robot will light up. When charging is completed, the re-charging will stop automatically. You need to manually switch off the "Forced Charging Switch" after use.



## VI. Robot Operations

Please refer "i90 Robot Explorer Program" Manual for reference.

## VII. Programming

Please refer to the following documents for high level programming using ActiveX control on Windows environment.

Robot Sensing and Control: "WiRobot SDK API Reference Manual" and "WiRobot SDK API (Supplementary for Sentinel) Reference Manual"

Pan-Tilt-Zoom Camera: "PTZ Camera ActiveX Control Reference Manual"

Please refer to the following documents for low level programming using raw protocol:

Robot Sensing and Control: "PMS5005 Protocol Reference Manual with *Support for Constellation System and Power Controller*"

Please refer to the following documents for high level programming with "i90 Robot Explorer server program":

"i90 Robot Explorer Sever-Client Protocol"